Remarks:

Claims 2, 3, 5-14, 17 and 19-22 are pending in this application. Claims 2, 3, 17 and 19-22 are rejected. Claims 5-14 are withdrawn from consideration. Claim 20 has been canceled.

THE PRIOR ART REJECTION

Claims 2,3,17, 19, 21 and 22 are rejected under 35 USC 103 as being unpatentable over Brupbacher et al (US Patent 5059490) in view Gottselig et al.(US 4,961,529). and further in view of Kugler (US 4,410 412)

For an obviousness rejection to be proper, the Patent Office must meet the burden of establishing a prima facie case of obviousness. **The Patent Office must meet the burden of establishing that all elements of the invention are disclosed in the cited publications, which must have a suggestion, teaching or motivation for one of ordinary skill in the art to modify a reference or combined references.**[1]

The cited publications should explicitly provide a reasonable expectation of success, determined from the position of one of ordinary skill in the art at the time the invention was made.[2]

It is an object of the present invention to provide whisker reinforced metal matrix composite materials comprising in-situ precipitated complex ceramic whiskers distributed throughout metal matrixes. The invention is suitable for the manufacture of flat or shaped titanium matrix composite articles having improved mechanical properties such as lightweight plates and sheets for aircraft and automotive applications, heat-sinking lightweight electronic substrates, bulletproof structures for vests, partition walls and doors, as well as for sporting goods such as helmets, golf clubs, sole plates, crown plates, etc.

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1 *In re Sang Su Lee, 277 F.3d 1338, 61 USPQ2d 1430 (Fed. Cir. 2002).*

2 *In re Fine, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988); In re Wilson, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970); Amgen v. Chugai Pharmaceuticals Co., 927 U.S.P.Q.2d, 1016, 1023 (Fed. Cir. 1996);*

We agree with Examiner that The Brupbacher patent contains some hard particles mentioned in our original Application.

The Examiner acknowledges that The Brupbacher does not disclose the presence of the complex carbide-silicide particles in the titanium matrix composite material as recited in claim 21 on page 4 of the Office Action. For this reason, the Examiner has cited Gottseilig et al to supply the missing teaching of Brupbache

We agree with Examiner that The Brupbacher does not specify the presence of the complex carbide-silicide particles in the titanium matrix composite material as claimed.

Gottseilig et al. (US 4,961,529) invention **concerns a method of welding together silicon carbide parts or brazing silicon carbide and metal parts together by means of a special bonding layer on a silicon carbide joint surface.** It includes the provision of a silicon carbide component having a joint surface prepared for brazing to a metal part.

The Gottseilig et al. (US 4,961,529) invention is about brazing silicon carbide parts by sintering Ti_3SiC_2 particles to form a solid layer of Ti_3SiC_2.

In the Final Office Action the Examiner wrote (p. 3 and p. 4) that

(a) It would have been obvious to one of ordinary skill in the art that during the direct synthesis process of Brubacher et all ('490) the claimed Ti_3SiC_2 would be formed in the presence of SiC and Ti as evidenced by Gottselig ('529) abstract, and

(b) it would have been obvious to one of ordinary skill in the art to substitute the carbides (e.g., TiC) with the claimed Al_8V_5 in the titanium matrix composite with an expectation of success because the carbides and Al_8V_5 are functionally equivalent as disclosed by Kluger (US Pa. 4410412, col. 1, lines 34-40 and Example 2).

We disagree with Examiner that it would have been obvious to one of ordinary skill in the art that during the direct synthesis process of Brupbacher et al US Patent 5059490 the claimed Ti_3SiC_2 would be formed in presence of SiC and Ti as evidenced by Gottseilig et al. (US 4,961,529) (abstract). Gottseilig et al. (US 4,961,529) does not relate to titanium matrix composite at all. This layer cannot be used for reinforcing titanium matrix composites.

Both assertions are wrong.

This is not absolutely obvious that Ti_3SiC_2 will be formed during sintering of SiC with Ti, and Examiner cannot prove the formation of this compound scientifically. **Silicon carbide SiC is very stable and inert material in the temperature range of conventional sintering processes of manufacturing titanium matrix composites.** Therefore, we prepare complex carbide particles such as above mentioned Ti_3SiC_2 particles and incorporate them into the powder mixture BEFORE SINTERING, that we claimed in our invention.

In the present invention "a fully-dense discontinuously-reinforced titanium matrix composite material comprising (a) a matrix of titanium or titanium alloy as a major component,

(b) Ceramic and/or intermetallic hard particles dispersed in the matrix in the amount of 50% by volume or less include particles of Al_8V_5 compound, and

(c) complex carbide- and/or silicide particles that are at least partially soluble in the matrix at the sintering or forging temperatures such as $Ti_4Cr_3C_6$, Ti_3SiC_2, Cr_3C_2, Ti_3AlC_2, Ti_2AlC, Al_4C_3, Al_4SiC_4, $Al_4Si_2C_5$, Al_8SiC_7, V_2C, (Ti,V)C, VCr_2C_2, and $V_2Cr_4C_3$.

"as claim in independent claim 21.

The Examiner acknowledges that The Brupbacher and Gottseilig et al does not disclose the presence of the intermetallic compound of Al_8V_5 in the titanium matrix composite material as recited in claim 21 on page 4 of the Office Action. For this reason, the Examiner has cited **Kugler** to supply the missing teaching of Brupbacher and Gottseilig et al

The second reference on Kugler's Patent is irrelevant to out invention.

Kugler (US 4,410 412) does not relate to titanium matrix composite at all.

The **Kugler** invention relates to **an exchangeable, wettable solid cathode for an electrolytic cell for producing aluminum** via the fused salt electrolytic process. "An exchangeable, wettable solid cathode for a fused salt electrolytic cell for the production of aluminum is made out of at least one aluminide of the groups IV A, V A or VI A of the periodic system of elements. A titanium aluminide of the .gamma.-phase has been shown to be particularly favorable for this purpose" (see Abstract of the **Kugler's** invention).

There are several competitive (but not mixed together) carbides or aluminides of titanium, zirconium or vanadium). Referred by the Examiner text (*lines 34-40 in col. 1)* relates only to

carbides but not to aluminides: "In the fused salt electrolytic process for making aluminum it is known to employ wettable, solid cathodes. It has been proposed therefore to employ cathodes made of titanium diboride, titanium carbide, pyrolytic graphite, boron carbide and other substances, including mixtures of these substances which may have been sintered together. "

And this is understandable because carbides and aluminides have different electrode potentials, and the patent is **about the electrolytic cell and electrode for producing aluminum from the electrolyte.** If we, or the Examiner, (or Kugler) will manufacture the electrode containing both titanium carbides and vanadium (or zirconium) aluminides, such composite electrode will not work properly in the electrolyte and liquid aluminum and will be destroyed by erosion, soon. This means, that an addition of Al_8V_5 to titanium in the electrode is not suitable.

Example 2 and claims of Kugler's patent showed electrodes made of separate aluminide compounds (zirconium aluminides, or molybdenum aluminide, or vanadium aluminides) that are not mixed neither between each other nor with carbides. The only example of ZrTiAl5 means that Kugler probably tested this complex aluminide compound individually, but this does not mean that any other combinations are obvious.

Claim 1 of Kugler's patent confirms this by asserting that the electrode is "...substantially entirely aluminide...". There is no word about the composite with titanium carbides.

Neither one of prior art documents: Brupbacher et al. (US 5,059,490), Gottseilig et al. (US 4,961,529) **contain aluminum-vanadium Al_8V_5 hard particles which is incorporated into titanium matrix according to our independent claim 21.**

We agree with the examiner, those above-mentioned carbides, silicides, aluminides and other compounds can be formed in the matrix during sintering, as the result of reactions between components of the initial powdered blend. **However, they either can or cannot be formed, nobody can control this process completely**. Therefore, we include such powders as Al_8V_5 and $TiCr_2$ in ready form into the basic blend which will be subjected to compaction and sintering, while in the prior art, these particles are resulted from the chemical reaction during the sintering, and the inventors cannot prove if they really appeared or not. We incorporate these particles in

the predetermined amount and with the predetermined particle size, in other words, we control the effect of these dispersed particles on mechanical properties of the resulting titanium matrix composite. Intermetallic particles Al_8V_5 play a very important role in hardening of the titanium matrix composite based on the Ti-6Al-4V matrix as the matrix. The Al_8V_5 particles have the composition that is chemically very close to the matrix alloy, therefore they form very strong chemical bonds with the matrix alloy grains during sintering due to facilitated diffusion between said particles and the matrix alloy. Thus, the Al_8V_5 hard particles are most effective structural strengthening component among other hard particles, and the presence of Al_8V_5 hard particles is necessary in the invented titanium matrix composites.

Controlled uniform distribution of said particles in the matrix is possible only by incorporation them into the initial powdered blend before compaction and sintering the final product. We prepare the Al_8V_5 fine particles separately and mix them with titanium and other carbides and silicides before sintering. Only this approach allowed us to improve mechanical characteristics of targeted titanium composite.

Applicants assert that Brupbacher et al., Gottseilig et al and Kugler does not disclose, teach or suggest anything about flat or shaped titanium matrix composite articles having improved mechanical properties such as lightweight plates and sheets for aircraft and automotive applications, heat-sinking lightweight electronic substrates, bulletproof structures for vests, partition walls and doors, as well as for sporting goods such as helmets, golf clubs, sole plates, crown plates, etc., as claimed in independed claim 21 and depended claims 2, 3, 17 and 19.

In view of the foregoing, it is respectfully submitted new independent claim 21, and claims 2, 3, 17 and 19 respectively depending therefrom, clearly patentably distinguish over Brupbacher et al., Gottseilig et al., and Kugler singly or in combination, under 35 USC 102 as well as under 35 USC 103.

It is respectfully submitted that applicants' comprehensive discussion of the relied upon in the rejection and of the differences between applicants' claims and the prior art provides a firm basis